

# AMATEUR SATELLITE REPORT



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**AMSAT® NA Newsletter for the Amateur Radio Space Program**

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## **AMSAT OSCAR 10 Placed "Out of Service" For Two Months**

AO-10 is now nearing a period of critically low power due to rapidly decreasing sun-angles. According to analyses by G3RUH and N4HY, minimum power availability will occur on or about March 30. The spacecraft's entire power system will probably go through various indeterminate regimes wherein virtually any system configuration can result. System engineers and ground controllers will be especially poised and ready to respond should any potentially damaging conditions be established during this period.

The current serious situation was brought about by the failure of the satellite's IHU (computer) last year. Since then attitude maneuvering has been impossible. As the earth and spacecraft make their way around the sun, the angular relation between the spacecraft's spin axis and the sun changes such that at certain times of the year virtually no sunlight illuminates the solar panels. Available power shrinks to near zero. However, after that, angles improve and the satellite can reasonably be expected to return to service if no serious damage has been incurred during the critical period. AO-10 will return to service around May 1, 1987 if all goes well over the next few weeks.

Consequently, the satellite has been withdrawn from all use until May 1st. AMSAT leaders around the world are emphasizing the urgent need for all stations to comply with a call for total non-use of the satellite during this period.

## **Short Bursts**

- Thanks go to Bill Reed, WD9ETZ, and Bob Stricklin, N5BRG, for putting together the fine packet station which was demonstrated to about 80 delegates (25 countries) at the International Informatics Access '87 Conference. The conference was sponsored by Baylor University Research Center in Dallas the week of March 16. Many were keenly interested in packet as a viable low-cost communications option as well as the amateur satellite program and particularly the low earth orbit birds and PACSAT.
- The US Society has officially merged with the National Space Institute to form the National Space Society (NSS). The final ceremony took place at the Sixth Annual Space Development Conference in Pittsburgh, PA, on March 28. AMSAT has embarked on a broad range of cooperative efforts with the NSS including the new Phase 4 geosynchronous program.
- Radio Moscow has announced that the Progress Cargo ship has separated from MIR. The flight control center said that the operation was performed by the crew and ground services. On March 28 Radio Moscow announced the cargo carrier had reentered the atmosphere. Coincidentally, a large greenish meteorite was reported over the U.S. Pacific northwest but it is unknown at present if the two are connected. It is expected that within a few days the crew will receive a new unmanned space ship and the astrophysical observatory.

• Recent breakthroughs in the field of superconductivity have exhilarated physicists and engineers world-wide. They have also prompted AMSAT to begin looking at early space applications of the new higher temperature superconducting devices on an early launch opportunity. (Magnetorquers? Altitude pumps?) Individuals in the field are invited to contact AMSAT NA President WA2LQQ to exchange ideas in this regard.

• In the April/May edition of the fine new Smithsonian publication, *Air and Space*, there is an excellent collection of articles entitled "Eye On the Sky", by James E. Oberg. Of interest to OSCAR operators are many details of the satellite tracking and cataloging efforts of the North American Aerospace Defense Command (NORAD) of the US Air Force. This organization is responsible for keeping track of the thousands of space objects.

## **Call For Papers For the ARRL Packet Radio Conference**

The Sixth ARRL Amateur Radio Computer Networking Conference will be hosted by the TRW Amateur Radio Club, Redondo Beach, California, on Saturday, August 29, 1987. The conference will feature technical papers presented by internationally packet radio pioneers.

Papers are invited on Amateur Radio digital communication. In particular papers are invited in the following packet radio subject areas: transmission technologies, networking, network expansion and development, applications, operations, message handling, international matters, spectrum management and integration of data, voice and images. Prospective authors are requested to contact Mrs. Maty Weinberg, ARRL HQ, 225 Main Street, Newington, CT 06111, telephone 203-666-1541, for an author's kit. Camera ready originals are due at ARRL HQ no later than July 27, 1987.

## **TAPR Now Accepting FO-12 Modem Reservations**

**by Tom Clark, W3IWI**

The wait for the TAPR modems is just about over! W3IWI, WA7GXD and N7CL are in the final phases of the "productionizing" TAPR's 1200 baud PSK modem for weak signal terrestrial and FO-12 satellite use. The "alpha" test run of five boards revealed only a few very minor problems which have now been corrected. A small batch of "beta" boards have been made and the final checkout is in progress. Schematics have been CAD'd and the ordering of parts for the first production batch has started. Some final work on documentation will constitute the final step. It looks like kits can be in your hands before May Day. Let's review a few of the features of this design:

— Demodulator portion very similar to QEX, August 1986. The design uses a Costas loop with filters optimized for 1200 baud data and is designed to be used with "stock" SSB receiver. Performance seems



to be within 1-2 dB of optimum PSK demodulator. Lockup time is very fast — a TXD of about 50 msec has been used with “QSK” radios on weak signal paths.

- Digital AFC for tracking low-altitude satellites (e.g. FO-12) with Doppler rates of up to 60 Hz/sec works well with TS711/TS811/FT726/TS940 (and probably other radios with digital up/down steps of 10 or 20 Hz). Once locked, the modem does all the frequency tracking work for you.

- Demod also includes “carrier” lock detector for half-duplex use.

- Includes two LED “Bar-graph” indicators for tuning and PSK “S-meter”.

- Two modulators are included: “Manchester” for the FO-12 FM 2m uplink and “PSK” optimized for use with SSB radios for terrestrial applications.

- Modem has provisions for “in/out” switching to restore your TNC to normal applications plus provisions for selecting between two radios.

- Design has been extensively tested in the lab and on the air both in terrestrial and FO-12 satellite operation. This testing has led to some minor changes to the design published in QEX.

- IT WORKS!

The kit consists of 3 circuit boards: The main (3.6" x 4.6") modem board, a small (1.3" x 2.8") board for the digital display and a small board to facilitate connection of a shielded cable between the TNC's “modem disconnect” connector and the PSK modem. The kit will include all 21 IC's, LED indicators, resistors, capacitors, switches, and all electrical parts.

It WILL NOT include the case for the modem — the modem has been designed to fit into a \$3.99 Radio Shack box (# 270-252A). However, the kit will include drilling instructions and nice looking adhesive backed front and rear panels (complete with the TAPR cactus logo) for use with the Radio Shack box. You will also have to get a few other small parts at Radio Shack.

After going thru the parts list, including the peripherals like switches and LEDs, and bundling in the costs of the “alpha” and “beta” prototype development, it looks like the price for the first batch of units will be \$100 plus \$10 for shipping and handling. It looks like our first “run” will be 200 units. We already have “reservations” for about 50. The pacing item on kit delivery will be circuit board fabrication.

When we KNOW that we are within 30 days of being able to ship (that time interval being dictated by Federal Trade Commission rules) we will start taking orders officially. However, anyone who wants to put in an advance “reservation” (especially when backed up with “Green \$tamps” since ordering parts requires re\$ource\$ which come near and dear to a non-profit amateur R&D group like TAPR) will be welcomed. You may contact Chris at the TAPR office (602) 746-1166 Tuesday-Friday or write to TAPR at: Tucson Amateur Packet Radio, Box 22888, Tucson, AZ 85734

## Ten Meter PSK Packets Anyone?

by Tom Clark, W3IWI

Recently we some very exciting tests using my two prototypes of the TAPR PSK modem on 10 meters. The venue for the tests was Fairbanks, AK. My good friend Mike Rice, KL7YV, was telling me of his 6 meter meteor scatter packet experiments and was commenting that with 4800 and 9600 baud FSK (K9NG modems) they were lacking signal margin for establishing a reliable path to locations like Homer, Juneau, etc.

I told Mike that I had my PSK modems with me and we decided to give them a try on the air on a weak signal path. We set up one end at the site of my 85' radio telescope (from whence emanates the W3IWI/KL7 and KL7RA EME signals), nestled in a valley chosen to be a quiet if location. Quiet?! From the site I couldn't even hear the local 2m FM repeaters! At the site I had available a TS-940 and a small tri-band beam which was plugged into one of my PSK modems.

Mike put the other modem on the air from his place using his FT-980 (and later an FT-726 equipped with the 10m module). Given the knowledge that my end was in a notorious rf “black hole”, we started out running at 50-100W power levels. But after we exchanged our first packet we saw that we had scads of S/N margin. We started cutting our power down (and putting in attenuators in the receiver inputs) until soon we were running the equivalent of 2-5 milliwatts and we were still seeing packets with Bit Error Rates < 1x10E-4 (less than one part in 10,000).

We thus demonstrated on the air on 10m the same performance I had measured in the “lab” — PSK packets can be copied essentially error-free with signals that are only 6-8 dB above the noise level as measured in the (approx.) 700 Hz wide filters in the Costas loop demodulator (i.e. about 4-5 dB in the 2.3 kHz passband of a typical SSB radio). We kept the tests running for several days with nary a hitch. Radios stayed tuned in. Link performance was excellent. 28200 kHz PSK was a real winner!

Since 1200 baud is legal in the U.S. on 10m (& 6m), and since 10m is the lowest band for Novices and Technicians to operate digital modes and since no de facto standards exist for 10m (& 6m) packeteering and since PSK works well with “stock” SSB radios and since 10m (& 6m) hold the greatest promise for operational meteor scatter packet links and since the PSK modems work so well in a weak signal environment.....I would like to suggest we adopt PSK as the packet “standards” for these (virtually) virgin bands. Comments anyone?

## Project OSCAR Meeting Report; Major Donation Made To AMSAT

Project OSCAR has installed its new Board of Directors including John Pronko, W6XN, Chairman, and named Jim Eagleson, WB6JNN, President; Paul Shuch, N6TX, Technical Director; Ross Forbes, WB6GFJ, User Services; Nick Marshall, W6OLO, Secretary and Gil Morris, WB6KCJ, Treasurer.

The following are the results of the Project OSCAR annual meeting:

The 1987 Board of Directors comprises: Lance Ginner, K6GSJ; Nick Marshall, W6OLO; Gil Morris, WB6KCJ; Walt Read, W6ASH; Gene Root, WB6OOO; Ross Forbes, WB6GFJ; John Pronko, W6XN; James Eagleson, WB6JNN; Claude Lievsay, N6OO; Jim Oimet, K6OPO; Chuck Towns, K6LFH; Paul Shuch, N6TX; Bob Stein, W6NBI; Chuck Smallhouse, WA6MGZ Smitty Smithwich, W6JZY

The Board of Directors established policies regarding purchase of software for fund raising purposes, established a committee to finalize arrangements and plans for the May 1-3 VHF/UHF Convention in San Mateo and set aside \$1000 for CAS or Gateway Development activities. The AMSAT Intl proposal was discussed and Project OSCAR will evaluate participation once firmer plans are available. The board provided for participation of WB6JNN in the Phase 4 Study Team organizational meeting.

In related developments, Project OSCAR Chairman John Pronko, W6XN has announced a significant donation to AMSAT from Project OSCAR. In a letter to AMSAT President WA2LQQ he says:

“Dear Rip,

“Please find enclosed a check made to AMSAT for \$2300. This money is being contributed to AMSAT's general operations fund by Project OSCAR Inc. and represents all of the excess funds that Project OSCAR Inc. has accumulated from the sale of the Phase III Manuals. As you know Project OSCAR Inc. financed the publication and distribution of this manual and has since donated a large fraction of the manuals to AMSAT for distribution at ham fests and conventions. The proceeds from the sale of those manuals have been assimilated into AMSAT's general operating fund as well.

“Those of us at Project OSCAR Inc. who participated in this project feel proud of the success of this fund raising mission and know that the money will be well spent in furthering the amateur radio satellite cause. Feel free to call on us again if we can be of further service.

“Unfortunately the demand for the Project OSCAR Orbital Calendar, a document which has been a very successful fund raiser in past years, has diminished significantly in the past few years. The demand



for this document has diminished to the extent that it will probably be a financial liability this year. We attribute this decline in popularity to the extensive use of computers in tracking the amateur radio satellites and to the readily available NASA predictions. As a consequence it has been decided by Project OSCAR Inc. not to publish this calendar in its present form beyond the calendar year 1987. We suggest that AMSAT consider the possibility of meeting any need for this orbital prediction service through one of its periodical publications.

"Sincerely,

John Pronko, W6XN

Chairman of the Board of Directors,

Project OSCAR, Inc."

## **Testing FO-12 JD Continues Under Schedule Uncertainty**

Testing of Mode JD may be interrupted at any time for testing of the new "Mailbox" software which is expected to commence soon. Other tests planned are designed to assess the relative power consumption of both Modes JA and JD in order to determine an operating schedule which is commensurate with available power resources.

FO-12 was launched last August 12 and employs two transponders. Using the Mode J format, 2 meters up and 70 cm down, Mode JA is a linear transponder for analog modes. Mode JD is a digital mode for packet radio communication. Mode JD uplinks are FSK. The downlink is PSK. Several specially designed modems are now available to interface packet radio TNCs to the satellite. These have been detailed in the ASR and QEX publications of AMSAT and ARRL. G3RUH details how to interface his new FO-12 modem to various packet radio TNCs in ASR #146.

Observation of the FO-12 beacon is a reliable indicator of the mode then in use. Mode JA beacon is at 435.795 MHz. The Mode JD downlink and beacon is on 435.910. Doppler shift of the beacon can approach  $\pm 10$  kHz. JA passband and JD channel details appeared in ASR #119 and 130.

Since the satellite remains in an experimental regime, operating schedules may be irregular and change without notice. Plan accordingly.

## **NOAA-H Becomes GOES-7 and Preps For Full Operations**

Following its successful launch by NASA on February 26, NOAA-H was placed in a geo-synchronous orbit by its kick motor on the next day. The satellite was renamed GOES-7 after and it took its first pictures of earth on March 6. The spacecraft was turned over to NOAA for full operations after checkout procedures were completed on March 25. GOES-7 is a weather observation satellite and will be positioned to watch over the Atlantic for hurricanes this summer and autumn. GOES-6, currently positioned midway between Atlantic and Pacific, is being moved to typhoon watch duty over the Pacific.

AMSAT has learned from NASA sources that GOES-7 has an experimental SARSAT/COSPAS receiver aboard. NASA hopes to develop means of locating distressed vehicles from the geo-synchronous platform by way of this experiment. All prior SARSAT/COSPAS receivers relied on Doppler shift to make QTH determinations. Geo-synchronous satellites exhibit no Doppler shift at all. Current SARSAT/COSPAS transponders are on NOAA-9 and 10 as well as two Soviet COSMOS series navigation satellites all in polar orbits.

## **Meeting Proposed To Form AMSAT International**

In a letter to over two dozen satellite community leaders around the world, AMSAT NA has suggested a meeting of leaders in Brazil this summer to form the basis of a new organization embodying the concept of AMSAT-International. The invitation results from an AMSAT Board of Directors resolution last year.

The CTA (Centro Tecnico Aeroespacial), parent organization of the Brazilian space agency, INPE (Instituto de Pesquisas Espaciais), has agreed to host the meeting. BRAMSAT President Junior DeCastro, PY2BJO, is helping to organize the meeting. Brazil has an emerging launch capability that may prove helpful to amateur satellite interests in the future.

So far, leaders from several nations have indicated their enthusiasm for the idea of an international clearing house for satellite operating news and a coordinated approach to member services and satellite operations. Several leaders have, however, expressed dismay at the high cost of traveling to Brazil to organize such an coordinating body. IARU has been invited to send an observer.

## **UoSAT OSCAR 9 Imagery Tests Reported**

UO-9 transmitted a test pattern from the CCD Imaging Experiment on March 11 comprising vertical black and white bars. These should have allowed stations to check out their reception, decoding and display equipment. Many thanks for those who sent in their results to the University of Surrey UoSAT Unit. As you will recall from prior UoSAT bulletins, taking images of Earth with the UO-9 CCD experiment is very difficult since the spacecraft does not point continuously at Earth (like UO-11) but rather sweeps through periodically. Thus, picture "snapping" has to be done "manually" in real-time over the University of Surrey and synchronized with the spacecraft's sweep past the Earth. It is this complex procedure that gives rise to the low success rate so far — but Surrey's working on it!

There have been several reports of "noise" on the UO-9 2m beacon. Please send your reports on this phenomenon (if you hear it) to Surrey please.

## **RS-9 Postponed Indefinitely But RS-10 Expected Soon**

Leonid Labutin, UA3CR, says the Radio Sputnik 9 Amateur Radio satellite will be postponed indefinitely. Leo was quoted by Pat Gowen, G3IOR, Sunday, March 21. However, RS-10 was expected to be launched in the June time frame says Pat again quoting Leo. Both satellites had been expected to be launched early in 1986 but have been repeatedly postponed. No explanation for the "indefinite postponement" of RS-9 was provided. It was uncertain if that meant cancellation of the payload.

Meanwhile, signals heard on 10 meters on frequencies previously specified for RS-9 combined with several recent Russian launches of the type normally associated with RS-9's have fueled speculation that RS-9 may have already been launched. The signals were heard on 29.3619 and 29.402 MHz on March 23 by DL1CF. According to the observer, the Doppler shift was consistent with RS birds. No precise track was established based on the observation, however. The signal at 29.3619 MHz was said to be emitting a "tick" sound every second.

For the present we are left with a puzzle but several possible explanations can be proffered. RS-1 has been heard regularly on 29.402 even though it ceased regular operation years ago. RS-4 had a powerful 1 watt beacon on 29.360 MHz. RS-4's function has never been fully explained and it has not been observed for several years either. Nevertheless, both RS-1 and 4 were known emitters on the frequencies now under scrutiny. (See ASR #26, Feb. 8, 1982.)

More remote is the possibility the signals now being heard on 10 meters are in fact RS-9 but that a malfunction has occurred. Still more remote is the likelihood that RS-9's mission was switched and that it's in orbit doing other than Amateur Radio things.

According to some observers, the most likely explanation is the simplest one. That is, that due to continued schedule pressure, one of the Amateur Radio packages had to be cancelled or put on indefinite hold. RS-9 is the less sophisticated of the two so its choice was obvious. RS-10 will be launched as soon as the launch backlog can be moderated. And very recent observations suggest DL1CF's observation may have a terrestrial explanation.

Meanwhile, observations of the two frequencies 29.3619 and 29.402 would be helpful to help reduce the uncertainty of the present situation.



## AMSAT Announces Preliminary Plans For New "Techno-Sports"

AMSAT NA says it is advancing plans for a new addition to the AMSAT Technical Achievement Award Program to be implemented on FO-12, Mode JA, once regularly scheduled operations commence. The program would focus on radio-location techniques such as employed by the SARSAT/COSPAS satellites. These are the search-and-rescue satellites operated by the United States and the Soviet Union in cooperation with Canada, France, United Kingdom, Denmark, Finland and Bulgaria.

AMSAT's new Technical Achievement Award would go to the stations who best determined the terrestrial QTH of an "Unknown uplinker" using relatively simple Doppler measurement techniques.

The ZRO Award Program, an activity to promote, encourage and reward superior AO-10 receive capability, was the first entry in AMSAT's Technical Achievement Award Program. The ZRO-Award is essentially a receive sensitivity test. It began in 1985 and may return later this year on Phase 3C Modes B and J and even perhaps Mode S.

The as-yet-unnamed radio-location award program would itself be one of series of new activities to be sponsored by AMSAT NA on the new generation of satellites now appearing, according to AMSAT President Vern Riportella, WA2LQQ. The Doppler shift method is "entirely appropriate for FO-12" Rip says in an upcoming article on the SARSAT/COSPAS Program and AMSAT's derivative competition based on it. However, AMSAT is evaluating a different, much more intriguing method using "Time Difference Of Arrival" (TDOA) to be used on Phase 3C, Rip added. The Doppler shift on P3C will be too low when the bird is near apogee to allow the same methods to be used on both P3C and FO-12 according to WA2LQQ. The multi-part satellite-aided radio-location article will appear QEX, the joint AMSAT-ARRL Technical Journal in the near future.

According to WA2LQQ, AMSAT's Awards Program will be in full swing once Phase 3C is up and running, all part of a new concept

called "Techno-Sport". "The idea" Rip said recently, "is to promote some challenging, fun-type activities on the birds with an implicit educational component throughout each activity. This way we broaden our appeal and better fulfill our charter at the same time." He suggests that a whole range of similar activities are being evaluated not only for FO-12 and P3C, but for RS-9 and 10 as well. These will "build on the Radiosport theme" Rip concluded.

## Launch Success String Ends In Thunderstorm At Canaveral

The recent string of launch successes enjoyed by NASA ended in a spectacular spring thunderstorm on Thursday afternoon, March 26. A \$161 million launch went into the Atlantic Ocean as the Atlas Centaur launcher suddenly veered off course forcing range safety officers to destroy the rocket and its payload by activating the self-destruct detonators. A military communications satellite, Fleetsatcom F6, was lost.

Immediate speculation focused on a severe thunderstorm which had been in the area. Although the launch pad area itself was not strongly affected by the storm and launch rules allowed for the countdown to proceed given the storm's proximity to the Cape Canaveral launch pad, upper cloud discharges may have affected the launch. The mission was destroyed by radio command 51 seconds after launch.

The payload was the last in a series of geosynchronous military communications satellites designed to provide connectivity to ships and aircraft. It cost about \$60 million. The Atlas Centaur, a venerable launcher in the U.S. fleet is among the world's most reliable launch vehicles. The Atlas itself has a history going back to 1962. Of 67 Atlas Centaur launches, all but seven have been successful. NASA immediately convened an accident board to probe the loss. The failure ended a string of successes including last week's launch of a commercial payload, a geosynchronous satellite for Indonesia by a Delta launcher.

## AMSAT® NA

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### Satellite Packet Experiments Reported

Experiments are now being conducted to link packet radio stations in the United States via a high-speed digital link from coast-to-coast. W3IWI reports a full-time satellite-linked packet channel is being used for relaying packets between the Washington D.C. and San Francisco areas. The western terminus is at Stanford University (WB6FFC-1) and the eastern terminus is at the University of Maryland (WA3YMH-1). Both ends of the link are operating on 145.01 MHz in their respective areas. Both ends of the path are "beta" test sites for the new W6IXU/WA8DED NET/ROM code which runs in stock TNC-2's. The two sites are interlinked at 9600 baud (running over a 56 kbaud full-duplex satellite link). The NET/ROM code provides level 3 and 4 linking services and ties the East Coast to the W6AMT-x network serving all of California.

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